
DMSO JPSD Experiment

AMG-15 10/9/96

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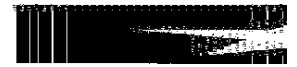
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Agenda

- Overview of JPSPD Experiment
- Federate Object model
- Federate Common Software
- Result Summary



Objectives of JPSD Experiment

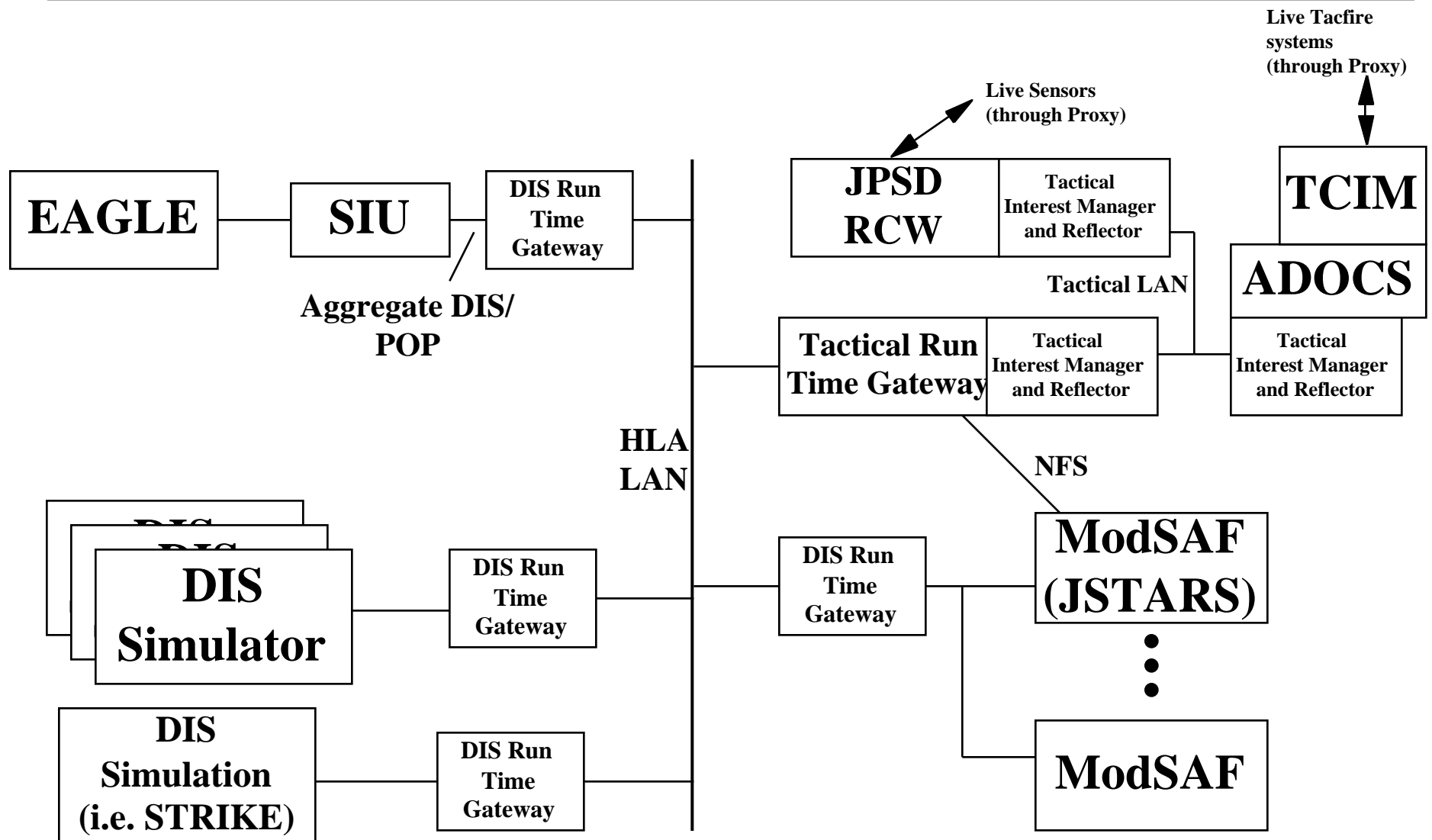
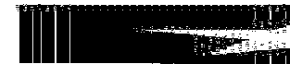


- Adapt the present JPSD CLCGF Federation to the HLA using the RTI:
 - Investigate HLA extensibility to a federation of aggregate, entity, and MITL C&C systems.
(real-time, time managed, and engineering)
 - Exercise the Aggregation/Deaggregation and C4I support within the RTI
 - Take advantage of the extensive infrastructure in place within Joint Precision Demonstration.
- Provide Continuous feedback on interface spec. and performance to the AMG

CLCGF: Corp Level Computer Generated Force



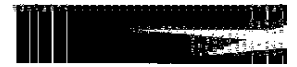
CLCGF Architecture



SIU: Simulation Interface Unit
JPSD RCW : Intell Reconfigurable Workstation
ADOCS: Automated Deep Operation Control System
TCIM: Tactical Communication Interface Modem



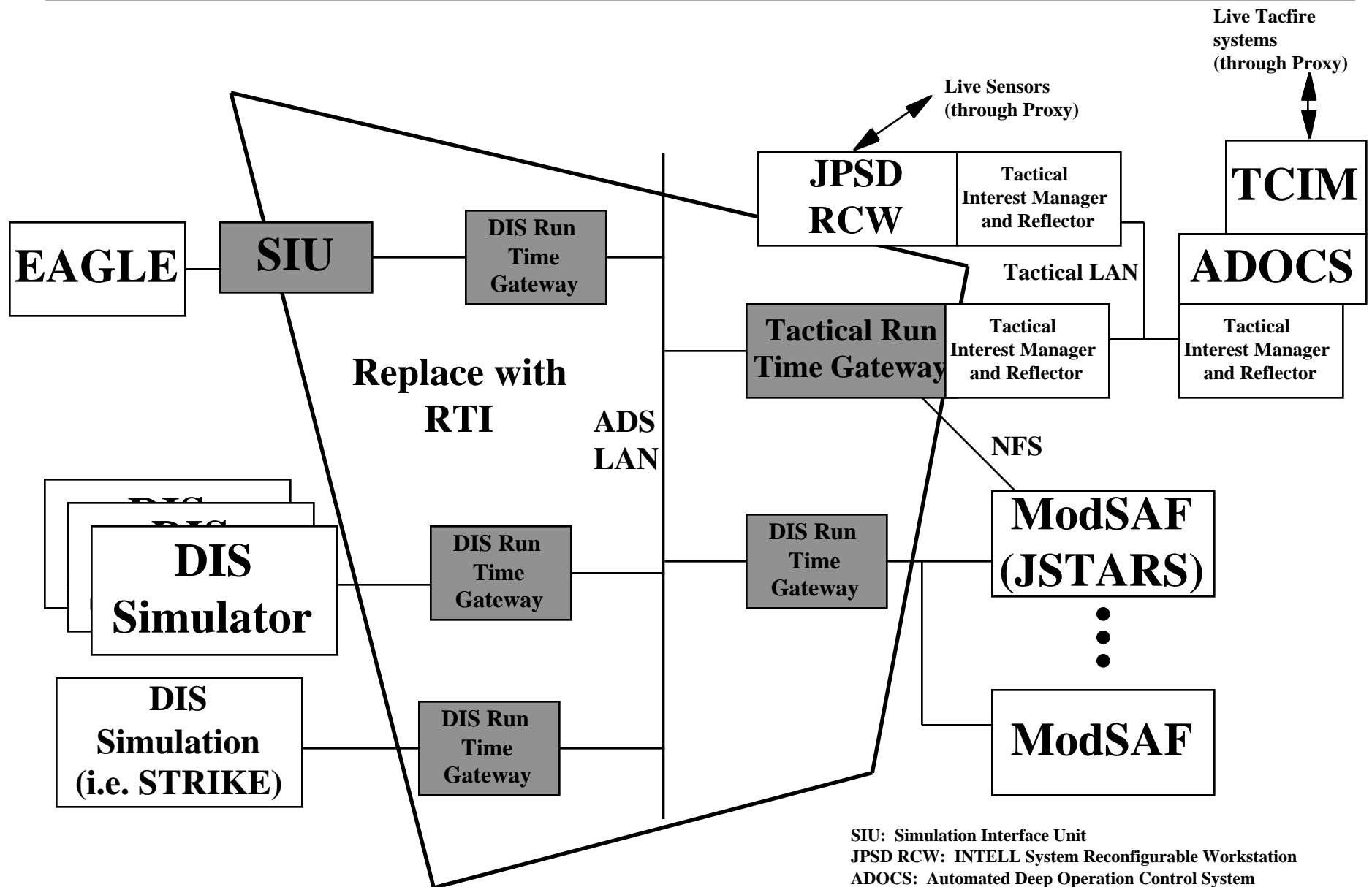
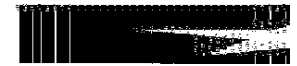
Technical Approach



- Create the FOM using the HLA Object Model Template
- Make minimal changes to the application code, just the interface to the RTI
- Repeat what CLCGF does now but with HLA RTI
 - Strip out Simulation interfaces to the public world view
 - Replace part of the SIU, Tactical Run-time Gateway, and DIS Runtime Gateways with Federate Common Software and the RTI.
 - Create a Exercise manager
 - Create a Data Collection Manager (MOP)



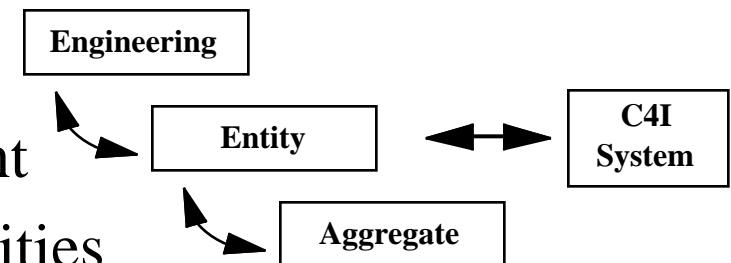
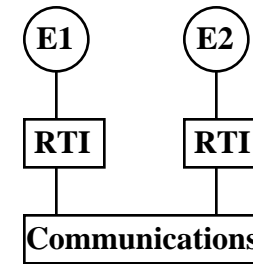
Replace CLCGF Runtime Components With RTI



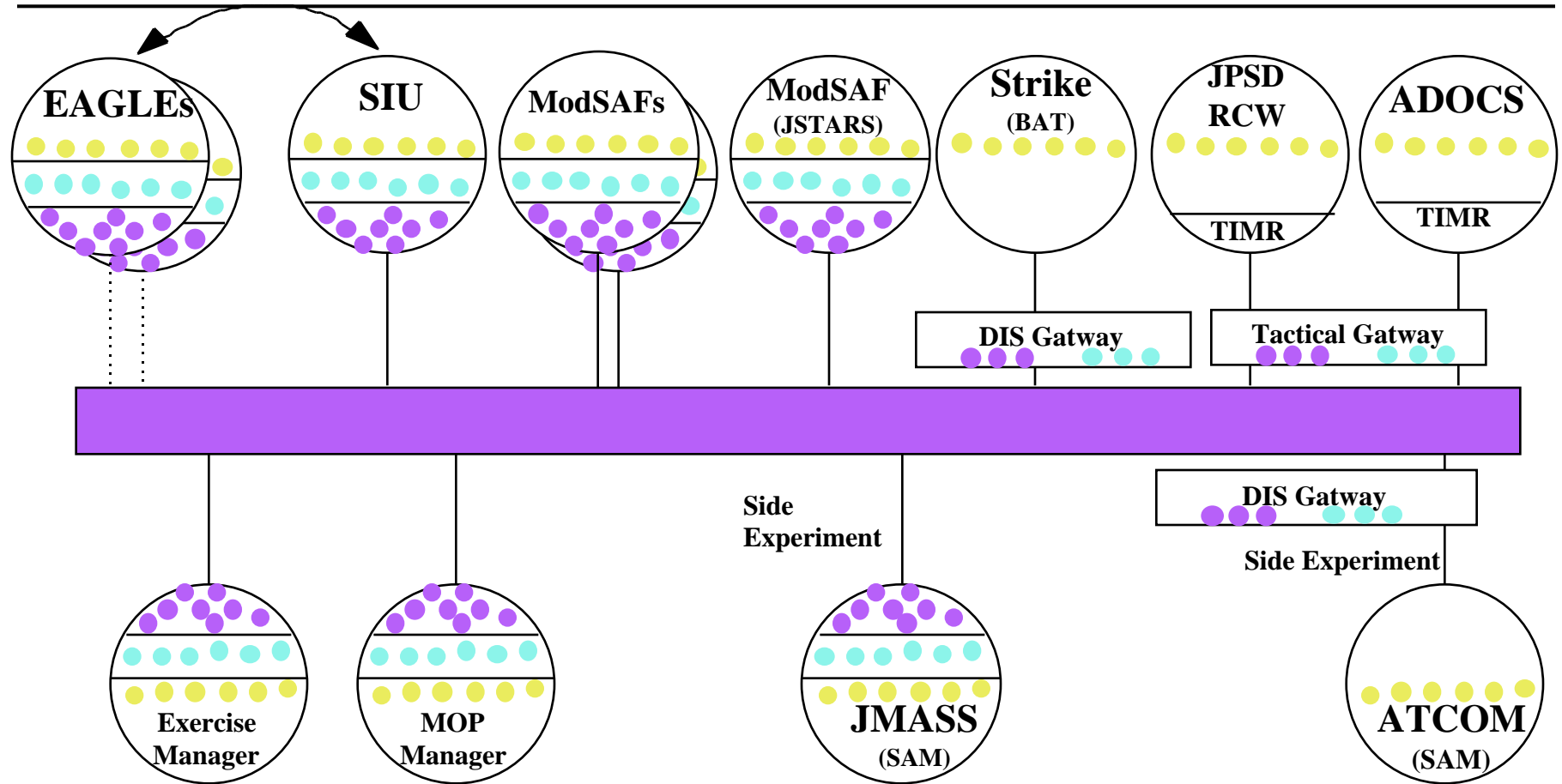
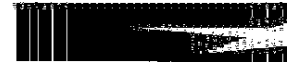


Test to Address Key Technical Issues

- Use existing applications within an Army scenario to quantify HLA
 - Latencies
 - RTI performance data
 - Communication performance data
- Test Hypothesis that the RTI can support the present CLCGF federation and JPSPD scenario
 - Required Latency
 - Time and ownership management
 - C4I interfaces with surrogate entities



JPSD Experiment

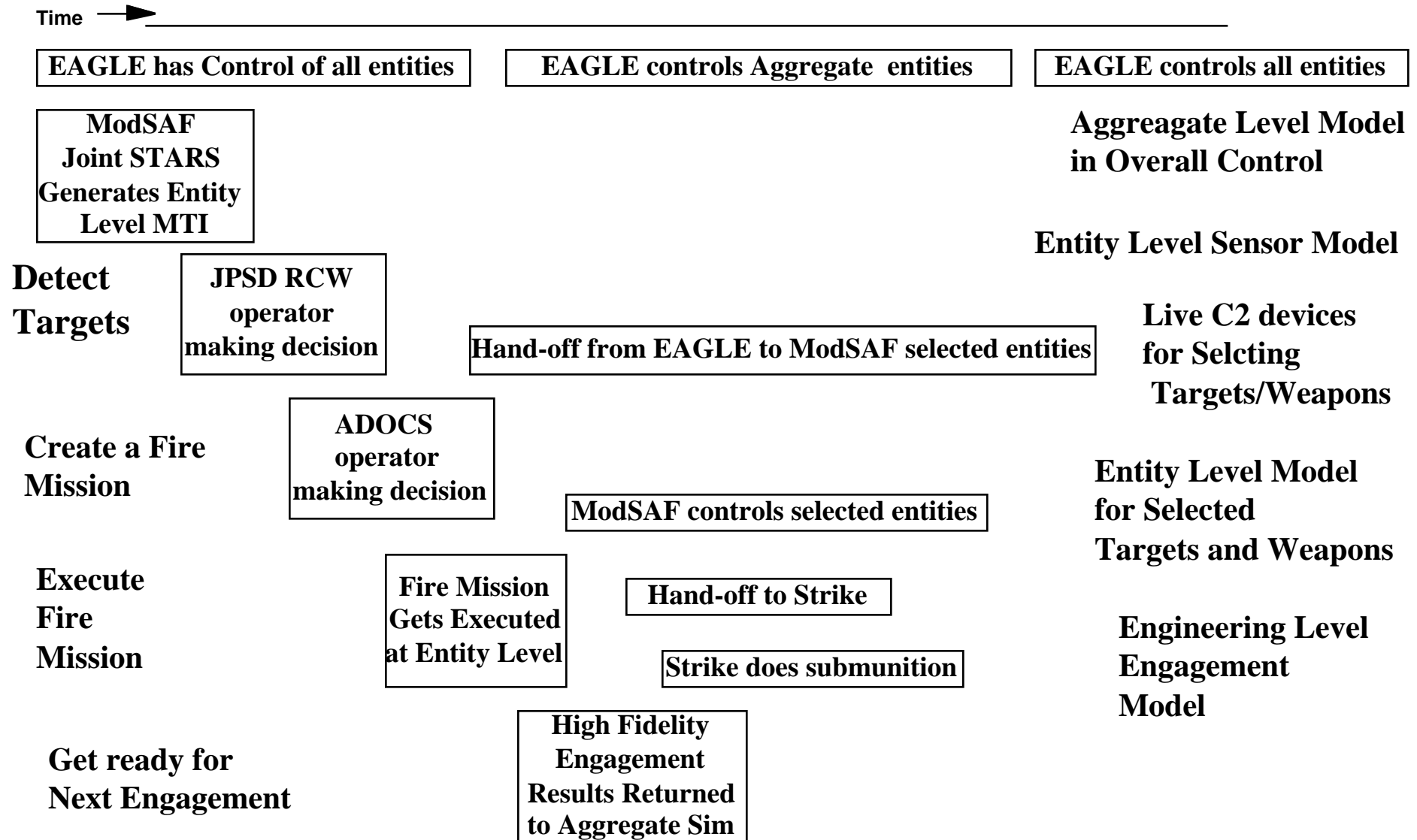
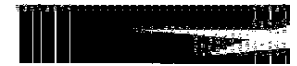


- Federate Specific Software
- Federation Common Software
- RTI Software (HLA Common SW)

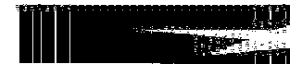
- Further Investigate Multi-level Interaction
- Further investigate ownership management
- Assess ease/approaches of integrating other FOMs



Scenario Activity Timeline (Deep Strike Against Moving Armor)



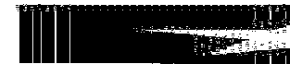
- Started with existing well-defined scenario
 - Translated JPSPD Interface Requirement Specification (IRS) to OMT format
 - Refined JPSPD Interest Mgmt. scheme (multicast groups) to HLA IM scheme
- Tools
 - Manual entry into Excel Workbook. Tedious and hard to maintain due to multiple views of the same data. (Majority of time spent here)



- DIS-like Data Representation

| | | | | |
|--------|----------|---------------------|----------------------------|-------------|
| Entity | Platform | Land | Tank | M1 |
| | | | | T72 |
| | | | | T54 |
| | | | ArmoredFightingVehicle | BMP - 1 |
| | | | | BTR80 |
| | | Air | SelfPropelledArtillery | M270_ATACMS |
| | | | | M109 |
| | | | SmallWheeledUtilityVehicle | M577A1 |
| | | | AttackHelicopter | AH64 |
| | | | | RAH66 |
| | Munition | AntiArmor | ElectronicWarfare | JSTARS |
| | | | UAV | HUNTER_2GEN |
| | | | Guided | BAT_P3I |
| | | BattlefieldSupport9 | ATACMS_MISSILE | |

- Class attributes are minimal fields of EntityState PDU for each entity type
- Interactions are used for sporadic PDUs, Tactical Messages, hand-off to engineering models, and Aggregation/Disaggregation



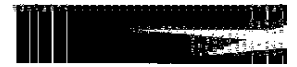
- Component Table specifies mapping between Aggregate and Entity representation (specifies ModSAF CLCGF template definitions)
- Data structure table defines complex attributes

| | |
|----------------------|-------------|
| RED_TANK_CO [9] | T54 [10] |
| | BTR80 [3] |
| RED_TB_PLUS [18] | BMP-1 [10] |
| | T72 [30] |
| BLUE_MECH_DIV_CP [1] | M1 [5] |
| | M577A1 [12] |

| DataStructure | Field | Datatype |
|---------------|-----------------|----------|
| RE_Reference | Title | string |
| | Originator | string |
| | Day | short |
| | Hour | short |
| | Minute | short |
| | SerialNumber | string |
| | SpecialNotation | string |
| | NASIScode | string |
| | Ampn | string |
| | Narr | string |



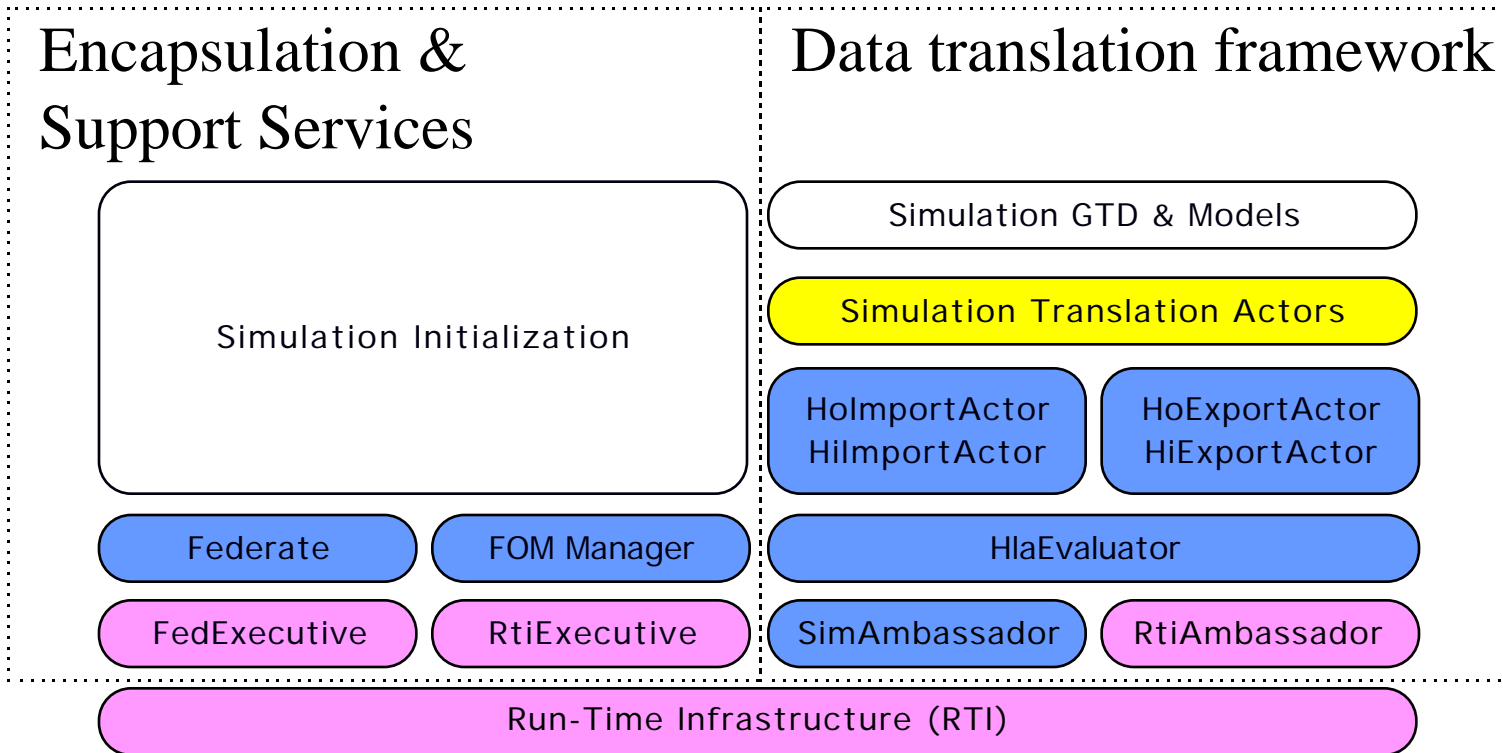
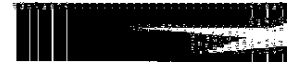
Federation Common Software (FCS)






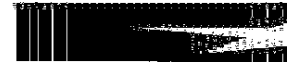
- Purpose: Develop software to facilitate the integration of CLCGF & HLA Testbed simulations with the RTI.
 - Encapsulation and automation of services all simulations must exercise (create/destroy/join/resign federation, publication/subscription, etc.)
 - FOM Management and RTTI services
 - Support for OO FOM data representation (deep class hierarchy etc.)
 - Efficient mapping between RTI Run-time typing and simulation compile-time typing
 - Framework for translation between simulation and FOM data representation
 - Common instrumentation for performance analysis



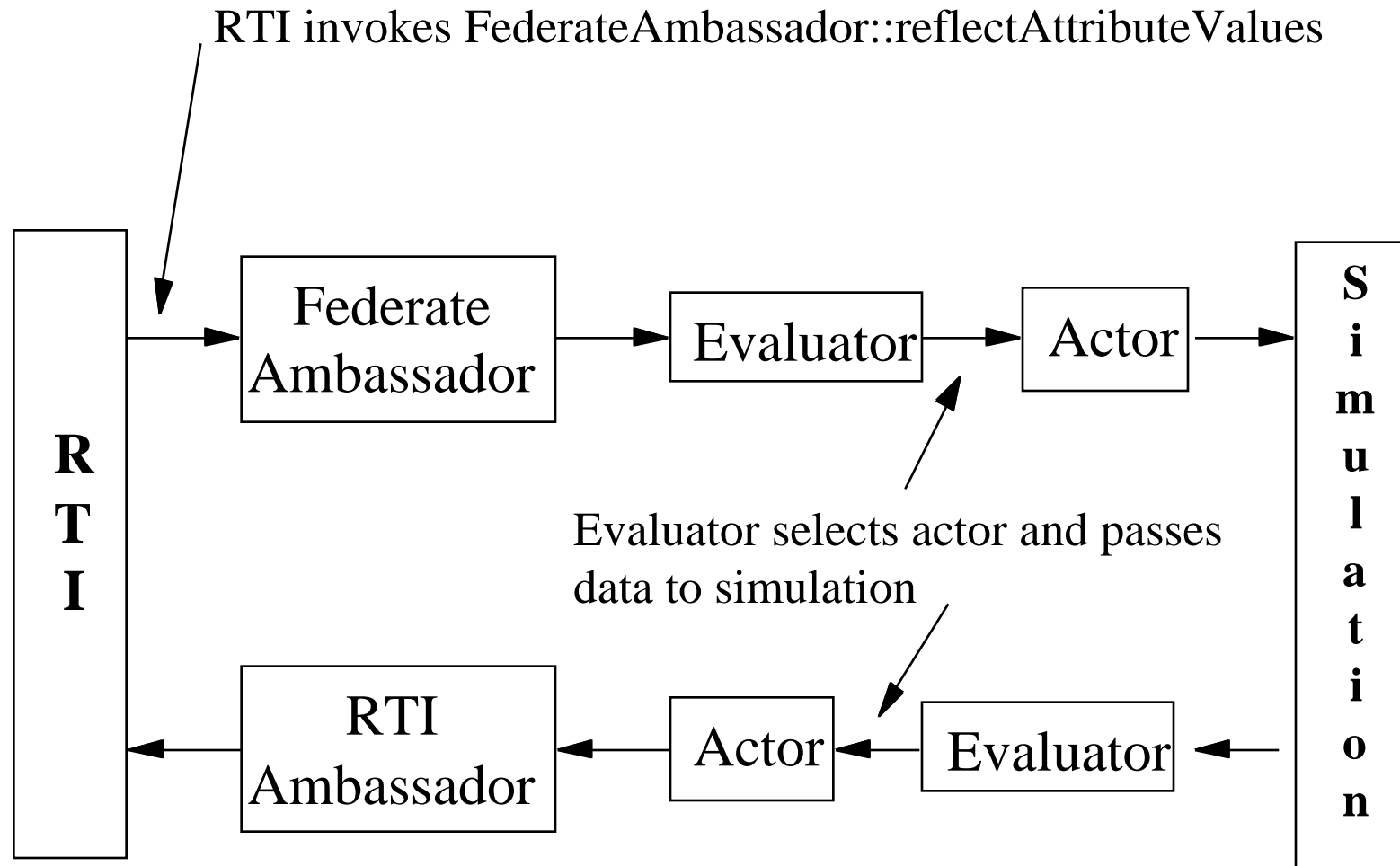
Federation Common Software



-  Simulation Translation Software
-  Federation Common Software
-  RTI Software

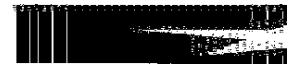


- Encapsulation and automation of services
 - Facade interface to RTI CORBA interfaces
 - Maintain collection of HLA entities known locally
 - Create federation and establish connection
 - Perform publication and subscription
- FOM Management and RTTI services
 - Support for derived classes
 - Efficient mapping between RTI Run-time typing and simulation compile-time typing

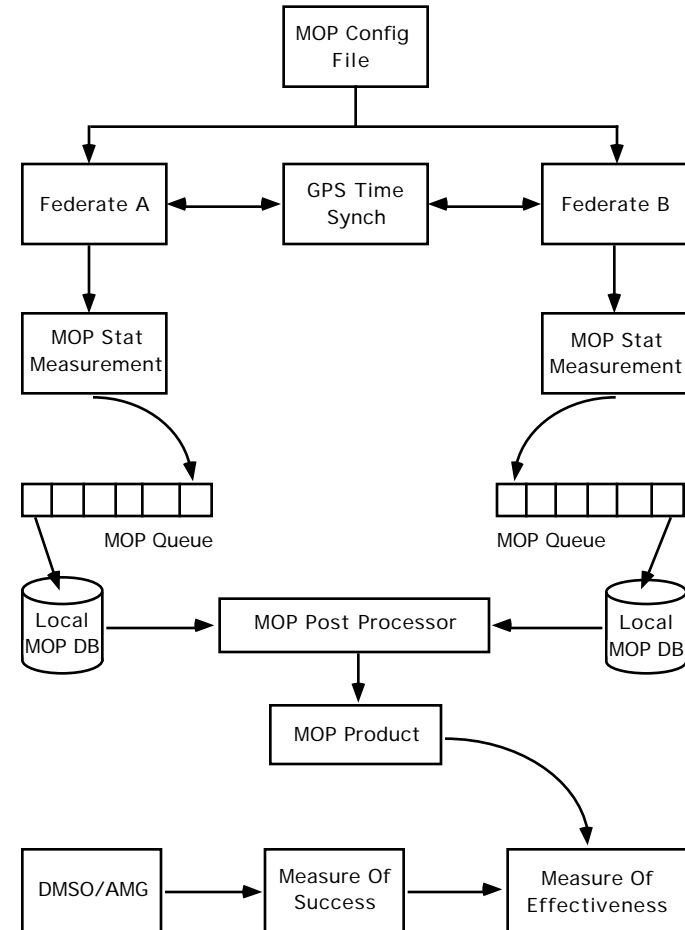




FCS/RTI Performance Instrumentation

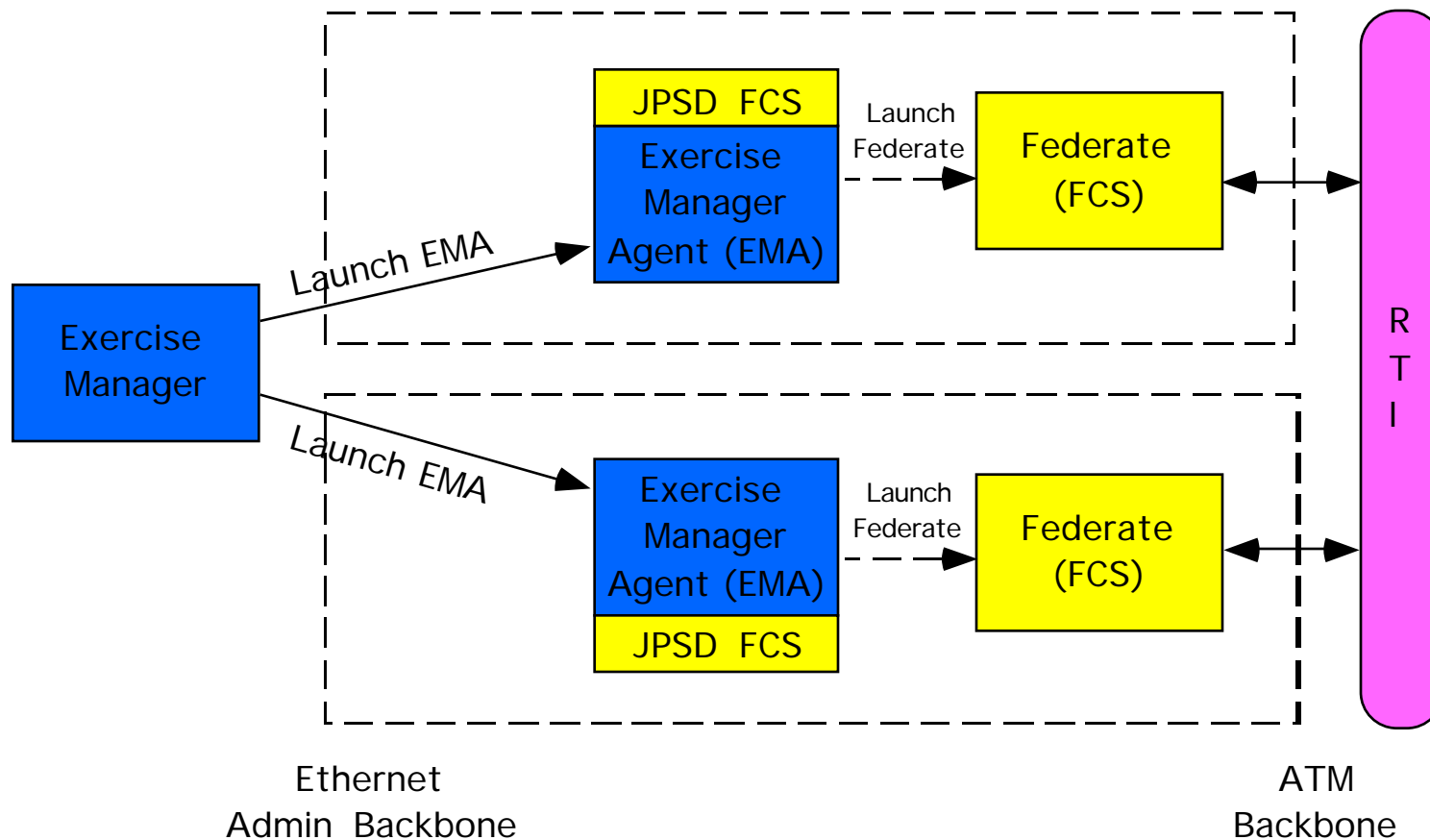
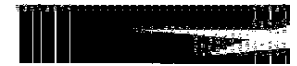


- Instrumentation Approach
 - Goal: Measure & collect with as little intrusion as possible
 - Log relevant RTI invocations for latency post-processing
 - Use separate thread for I/O to local DB to reduce intrusion
- Instrumentation Plan
 - Specifies required information for instrumentation of Performance Framework including Latency, Resource Utilization, Configuration & Control variables
- FCS extension
 - Instrument at RTI interface
 - Add persistence of MOP.data
 - Add support for compile & run-time selection of MOP's to collect



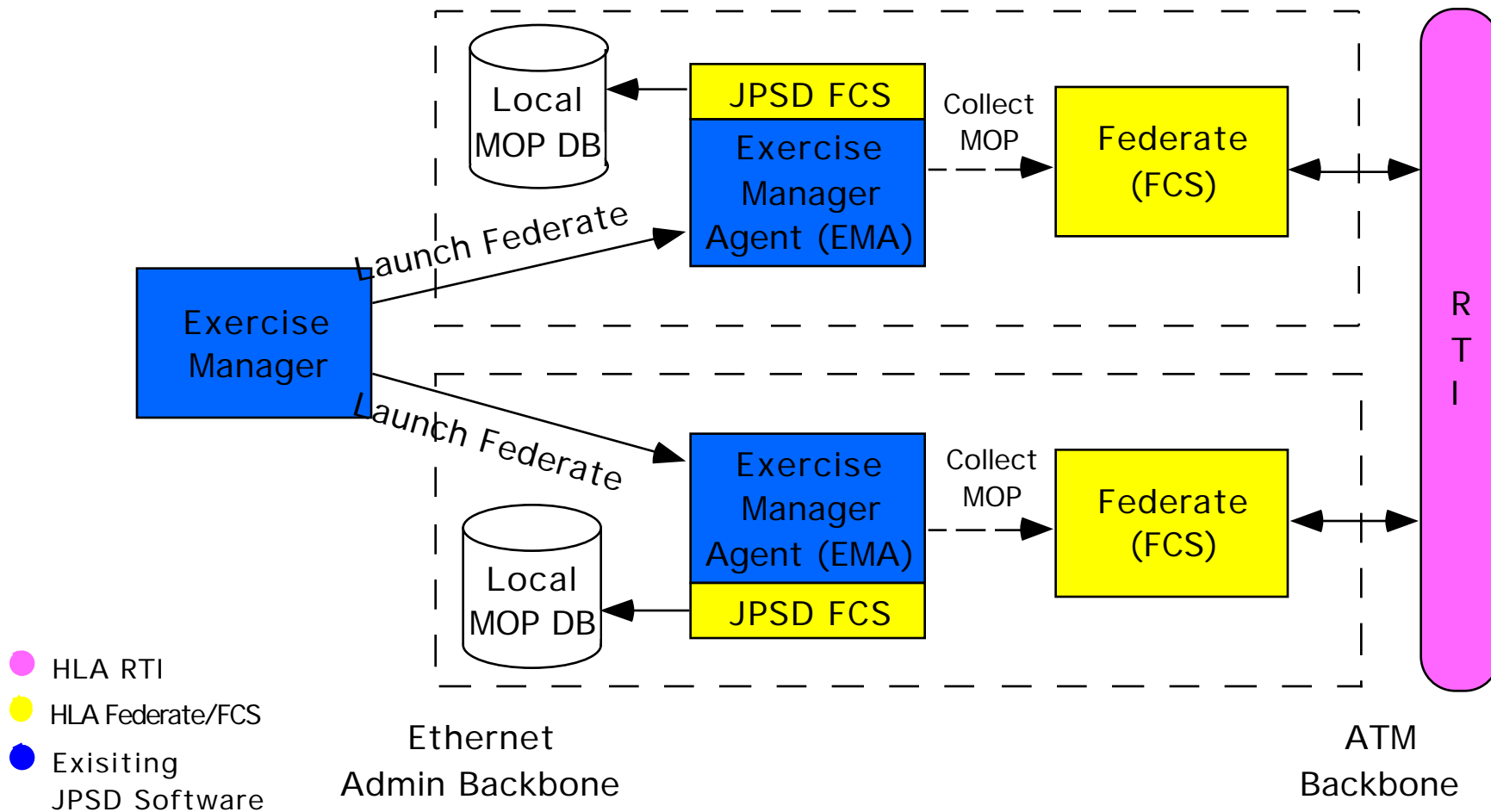
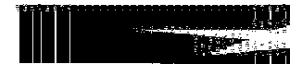


Exercise Manager Architecture





Process/Host Performance Instrumentation



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- Federate Changes
 - With our Federation Common Software (FCS) Library we have fewer changes in each federate
 - Various changes for time management to assure proper state updates in case of unordered delivery by RTI
 - Each Federate has specific code to extend the FCS Libraries
 - The most intensive software module is the interface between the simulations local world view and the FCS Evaluator and Actor classes for processing the attributes

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- Found that the HLA does provide required functionality to support CLCGF experiment
 - Aggregate, Engineering, C2, MITL, etc.
 - Prototype performance constraints required redefinition of normal JPSD CLCGF scenario (600 entities reduced to less than 100 entities)
 - Evolution of HLA definition resulting in support for derived classes